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NETWORK CONTROLLED CHANNEL
INFORMATION REPORTING

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BACKGROUND OF THE INVENTION

[0001]   The present invention generally relates to wireless communication systems, and particularly relates to the reporting of channel information in a wireless communication system.

[0002]   Channel information (e.g., signal to noise ratio on a particular channel or channel impulse response) helps characterize or otherwise describe a channel between a base station and a mobile terminal in a wireless communication system. If the fixed portion of the wireless communication system has knowledge of the channel characteristics, then the system can make adjustments to improve service. Indeed, the reporting of channel information from many mobile terminals back to base stations generally improves the system-wide performance of wireless communication systems. Further, the emerging multiple transmit antenna/multiple receive antenna systems see some of the most improvement from channel information feedback. It should be noted, however, that the theoretical amount and complexity of channel information that can be fed back increases as the number of transmit and receive antennas increases. Further, because of the time-varying fading environments encountered by mobile terminals, the feedback of channel information from the mobile terminals to the base stations should be timely.

SUMMARY OF THE INVENTION

[0003]   In one embodiment, the present invention provides a method of reporting channel information in a wireless communication system, the method comprising a mobile terminal normally providing a basic channel report to the relatively fixed portion

of the wireless communication system (e.g., to a base station), the basic channel report at least partially characterizing a downlink channel; the mobile terminal receiving at least one common feedback criterion broadcast to a plurality of mobile terminals; the mobile terminal determining if the mobile terminal satisfies a condition based on the at least one common feedback criterion; and the mobile terminal selectively providing an enhanced channel report regarding the downlink channel to the wireless communication system based on the determining. The basic channel report may comprise information related to a first set of one or more channel parameters of the downlink channel, and the enhanced channel report may provide greater detail on the first set of channel parameters than the basic channel report and/or the enhanced channel report may provide information related to a second set of one or more channel parameters of the downlink channel. In addition, the enhanced channel report may be a superset of the basic channel report.

[0004]   In another embodiment, the present invention provides a method of controlling channel information reporting in a wireless communication system, the method comprising: a base station receiving a plurality of basic channel reports transmitted from a plurality of mobile terminals, the basic channel reports at least partially characterizing a downlink channel from the base station; determining, by the base station, at least one common feedback criterion based on a desired amount of enhanced channel reports; the at least one common feedback criterion helping to define a condition whose satisfaction controls which plurality of the plurality of mobile terminals subsequently transmit an enhanced channel report regarding the downlink channel to the base station; and broadcast transmitting the at least one common feedback criterion from the base station to the plurality of mobile terminals.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]   Figure 1 shows a wireless communication network that may operate according to one or more embodiments of the present invention.

[0006]   Figure 2 shows a flowchart of one method of reporting channel information according to one or more embodiments of the present invention.

[0007]   Figure 3 shows one message arrangement that may be used by a mobile terminal to transmit channel reports.

[0008]   Figure 4 shows an alternate message arrangement that may be used by a mobile terminal to transmit channel reports.

[0009]   Figure 5 shows still another message arrangement that may be used by a mobile terminal to transmit channel reports.

[0010]   Figure 6 shows one possible embodiment of a mobile terminal that may operate according to one or more embodiments of the present invention.

[0011]   Figure 7 shows a flowchart of a method of reporting channel information according to one or more embodiments of the present invention.

[0012]   Figure 8 shows one possible embodiment of a base station that may operate according to one or more embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0013]   Figure 1 illustrates an exemplary wireless communication network 10, which may be configured as a WCDMA/Release 5 network. For reference, the WCDMA Release 5 standard is discussed in "Evolving WCDMA for Improved High Speed Mobile Internet," S. Parkvall, J. Peisa, A. Furuskar, M. Samuelsson, and M. Persson, in Proc. Future Telecommunications Conference, Beijing, China, Nov. 28-30, 2001, which is incorporated herein by reference. In general, network 10 typically includes a core

network 11 and a radio network. The radio network typically comprises a Radio

Network Controller (RNC) 12 coupled to a plurality of base stations 14 (sometimes

referred to as "node B's"). The RNC 12 may be thought of generally serving the function

of the more commonly known Base Station Controllers (BSC) found in many existing

wireless communication networks, such as GSM or IS-136 systems. The RNC 12

serves as a connection between the core network 11 and the base stations 14. The

RNC 12 communicates with various external networks such as the Public Switched

Telephone Network (PSTN) 104 and one or more Public Data Networks (PDNs, e.g., the

Internet) 106 through the core network 11. Mobile terminals 30 communicate to the

base stations 14 via the "air interface" as defined by the appropriate network standards.

Those skilled in the art will appreciate that other network architectures may be used,

and that network 10 may include more or different entities as needed or desired. In

general, detailed knowledge of the operational functions of the wireless communication

network 10 is not necessary for understanding the present invention, and such details

are not discussed further herein as they are considered to be understood by those of

ordinary skill in the art.

[0014]   As shown in Figure 1, each base station 14 is typically in direct

communication with a plurality of mobile terminals 30. While a maximum of three mobile

terminals 30 are shown in communication with a given base station 14 in Figure 1, it

should be understood that any number of mobile terminals 30 may be in direct

communication with a given base station 14. As understood by those of skill in the art,

the downlink communications from the base station 14 to the mobile terminals 30 may

be generally divided into "targeted" communications that are addressed to a single

mobile terminal 30, or to a small group of mobile terminals 30, and "broadcast"

communications that are intended for all mobile terminals 30 that are listening to the

base station 14. Further, the targeted downlink communications from the base station 14 to the mobile terminals 30, particularly packet data transmissions, are typically subject to a scheduling scheme that helps govern how often and in what sequence mobile terminals 30 receive data. For example, the base station 14 may operate under a "maximum throughput" scheduling scheme, where the base station 14 identifies the mobile terminals 30 that can take data at the highest potential data rates, and preferentially allocates downlink resources to them so as to achieve the maximum overall data throughput. Alternatively, the base station 14 may operate under a "fair" scheduling scheme, where the base station 14 identifies the mobile terminal(s) 30 with the lowest average data rate and preferentially allocates more downlink resources to it/them so as to achieve a more equal actual data rate between all the mobile terminals 30. Still further, the base station 14 may operate under a "proportionally fair" scheduling scheme, where the base station 14 allocates downlink resources to the mobile terminals 30 in proportion to the ratio of their current data rates to the overall average data rate so as to "help" the more disadvantaged mobile terminals 30 more than the advantaged mobile terminals 30. And, of course, there are other scheduling schemes known to those of skill in the art.

[0015]   In order for the scheduling schemes to work most efficiently, the base station 14 should know the characteristics of the downlink channels from the base station 14 to the respective mobile terminals 30 and other information such as present potential data rates, etc. Ideally, each mobile terminal 30 would report back enough channel characterization data so that the base station 14 would have complete knowledge of all the downlink channels. However, such complete feedback while theoretically useful, is decidedly impractical in most systems due to the very large amounts of bandwidth that would be required for each mobile terminal 30 to report back full channel

characterization data, and the consumption of mobile terminal resources (e.g., battery power) would be significant. Thus, the typical system has each mobile terminal 30 feedback only a certain very limited amount of information about the downlink channel. Indeed, the typical approach is to have each mobile terminal 30 report back only a single value known in the art as the channel quality indicator (CQI) as described in 3GPP technical specification 25.214, v5.3.0, entitled "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Physical layer procedures (FDD)(Release 5)", which is incorporated herein by reference. The reported CQI is indicative of the potential data rate given current downlink channel conditions.

[0016]   While reporting back the single CQI value has been effective for some systems, particularly single input single output (SISO) cellular systems, such an approach is less than ideal for many systems, particularly those systems 10 that use transmit and receive antenna diversity (multiple transmit antennas and multiple receive antennas). For such systems 10, the downlink channel from a base station 14 to a mobile terminal 30 is actually a composite of multiple sub-channels between the various antennas. As such, characterization of the downlink channel by a single value is imprecise at best. Instead, for the base station 14 to have a more complete picture of the downlink channels requires that the mobile terminals 30 feedback significantly more channel information. However, having each mobile terminal 30 regularly feedback this increased amount of information would have the negative effect of consuming significant system bandwidth, as discussed above, and depleting mobile terminal resources, such as battery or processing power.

[0017]   The process shown in Figure 2 shows one approach to reporting channel information that allows the network 10 to control the channel information reporting (or "feedback") so that some mobile terminals 30 feedback a greater amount of channel

information to the base station 14, while other mobile terminals 30 feedback only basic

channel information. The process begins with the base station 14 receiving channel

reports from the mobile terminals 30 (box 210). Based on those channel reports, the

data ready to be sent to the various mobile terminals 30 (i.e., data queued at the base

station 14 for transmission to the mobile terminals 30), and the base station's scheduling

scheme, the base station 14 determines if more descriptive channel information than a

basic channel report is desired from one or more mobile terminals 30. Based on that

determination, the base station 14 sets one or more common feedback criteria and

transmits the same to the mobile terminals 30 in a broadcast type message (box 220).

That is, the common feedback criteria are transmitted in such a fashion to be possibly

received and understood by essentially all the mobile terminals 30 using the base

station 14 (ignoring the effects of any transmission errors). Advantageously, this

downlink message from the base station 14 includes not only the common feedback

criteria, but may also include an indication of the relevant measurement window so as to

establish a common time interval between the base station 14 and the mobile terminals

30 for purposes of measuring average throughput.

[0018]   Just by way of non-limiting example, the base station 14 may use a downlink

broadcast channel, such as the Common Control Physical Channel (CCPCH), to

transmit the common feedback criterion and relevant measurement window. The

measurement window may optionally be defined as the interval starting from

transmission time interval N_0 and ending at transmission time interval N_1. The values N_0

and N_1 can be broadcast on the downlink common control channel. Because the values

of N_0 and N_1 will likely not vary rapidly, such a broadcast may not need to be repeated

frequently. On the other hand, the common feedback criterion may need to vary more

rapidly according to channel fading and network traffic conditions in order to efficiently

control the amount of feedback from the mobile terminals 30 on the uplink, as discussed further below.

[0019]   The mobile terminals 30 receive the common feedback criteria at box 230. Each mobile terminal 30 then determines whether or not it satisfies a condition based on the one or more common feedback criteria (box 240). For example, the condition may be a CQI of at least X, and a current average throughput of less than Y. If the mobile terminal 30 does not satisfy the condition, the mobile terminal 30 prepares a basic channel feedback report; for instance the traditional single value CQI, and transmits the basic channel feedback report to the base station 14 in a conventional fashion (box 250). If the mobile terminal 30 satisfies the condition, then the mobile terminal 30 prepares an enhanced channel feedback report and transmits the enhanced channel feedback report to the base station (box 260). The base station 14 then receives the channel reports from the various mobile terminals 30 (box 210), and the process continues. It should be noted that the normal or default setting of the mobile terminals 30 in this example is to supply the basic channel feedback report, with the enhanced channel feedback reports being provided when the mobile terminal 30 satisfies the condition(s) outlined by the common feedback criteria.

[0020]   One purpose of setting the one or common feedback criteria is for the base station 14 to control the number of mobile terminals 30 that report back basic channel reports versus enhanced channel reports. By adaptively controlling the parameters that trigger an enhanced channel report, the base station 14 can limit the number of mobile terminals 30 that send enhanced channel reports, at least indirectly. Thus, the base station 14 can set the common feedback criteria so that only a very few mobile terminals are predicted to be triggered to send enhanced channel reports, perhaps as few as one, perhaps even none. Further, through the selection of the common feedback criteria, the

base station 14 can tailor the triggering condition so that mobile terminals 30 of particular interest (e.g., those with the best or worst current possible transmission rates) provide the most detailed channel feedback via an enhanced channel report, so that knowledge of these particular channel conditions can be utilized to improve system performance.

[0021]   The common feedback criteria discussed above may take the form of individual threshold values, such as current potential transmission rate less than Y, but it should be understood that the common feedback criteria may also take the form of ranges, such as current transmission rate between Y and Z. And, as should be clear from the discussion above, the one or more common feedback criteria may relate to one or more parameters of the downlink channel and/or transmission parameters of the mobile terminal 30. However, the terms "common feedback criterion" and "common feedback criteria" as used herein specifically exclude any mobile terminal identification information, such as mobile terminal identity, user identity, ESN, IMSI, phone number, and the like.

[0022]   The mobile terminal 30 may either explicitly or implicitly signal whether the channel report being transmitted to the base station 14 is a basic channel report or an enhanced channel report. For instance, the mobile terminal 30 may use an explicit signal, such as the Transmit Format Combination Indicator (TFCI) 316 (see Figure 3), or may use an implicit signaling approach of using a different pilot pattern 314 (see Figure 4) when sending an enhanced channel report.

[0023]   Figure 3 shows one approach that may be used by the mobile terminal 30 to send a channel report on the uplink. As is understood by one familiar with WCDMA/R5, the mobile terminal 30 may transmit a basic channel report to the base station 14 using the High Speed Dedicated Physical Control Channel (HS-DPCCH) 320 for the channel

report itself and optionally using the Dedicated Physical Control Channel (DPCCH) 310 to indicate the presence/type of channel report. The mobile terminal 30 may transmit pilot patterns 312, TFCI 316, and Transmit Power Command (TPC) 318 on the DPCCH 310. When the mobile terminal 30 sends a basic channel report (step 250) the TFCI 316 would be set to a predetermined value (or one of a set of predetermined values) that the base station 14 would recognize as indicating that a basic channel report was being sent. The basic channel report data may be sent on the HS-DPCCH 320, for instance in the form of the conventional CQI 324, with the conventional ACK/NACK 322 for HARQ. On the other hand, when the mobile terminal 30 sends an enhanced channel report, the mobile terminal 30 may use a similar signaling arrangement, but with the TFCI 316 set to a different value (or one of a different set of values) that indicates that an enhanced channel report is being sent. Note that in the illustrative example of Figure 3, the channel report on the HS-DPCCH 320 may use twenty coded bits (typically corresponding to five information bits).

[0024] Alternatively, the mobile terminal 30 may use implicit signaling to indicate when the mobile terminal 30 sends an enhanced channel report. As shown in Figure 4, the mobile terminal 30 may transmit the DPCCH 310 as described above, but with a different pilot pattern 314. The mobile terminal 30 may also transmit the HS-DPCCH 320 with a lower spreading factor, thereby increasing the number of information bits that could be transmitted in a given time interval; the enhanced channel report could then be transmitted in the illustrated example with fifty coded bits. In such an arrangement, the enhanced channel report could be a superset of the basic channel report, in that it could contain the same information as the basic channel report (e.g., CQI 324) plus additional channel information. The base station 14, at step 210, would decode the DPCCH 310 using the "normal" pilot 312, and if this decoding failed, try the alternate pilot pattern

314. When the alternate pilot pattern 314 is detected, the base station 14 would then

decode the HS-DPCCH 320 accordingly to extract the enhanced channel report.

[0025]   In the example immediately above, the enhanced channel report was

transmitted over an existing control channel, the HS-DPCCH 320, using a spreading

factor that is less than the normal spreading factor. However, another alternative,

shown in Figure 5, would be to maintain the normal spreading factor for the existing HS-

DPCCH 320 and transmit at least a portion of the enhanced channel report on another

uplink channel, such as on the new uplink channel HS-DPCCH2 330. This HS-

DPCCH2 channel 330 could use the same spreading factor (e.g., 256 in the illustrated

example), or may use a different spreading factor so as to allow for a greater number of

information bits to be transmitted in the relevant time period. The presence of HS-

DPCCH2 330 may be detected blindly or through the use of an alternative pilot pattern

in the DPCCH 310 as described earlier.

[0026]   The enhanced channel report is intended to provide the base station 14 with a

better picture of the downlink channel as perceived by the mobile terminal 30 reporting

the enhanced channel report. As such, the enhanced channel report may provide more

detailed information than the basic channel report and/or may provide information on

different channel parameters than the basic channel report. For example, the basic

channel report may be the single value aggregate CQI discussed above, while the

enhanced channel report may be the signal-to-noise ratios for multiple antennas, the

measured power on the channel from each antenna, the estimated channel coefficients

and delays for multiple antennas, the decoding order for the different antennas,

impairment covariance matrix, measured noise power, and/or recommended data rates

for multiple data streams, etc. Further, as discussed above, the enhanced channel

report may include the information of a basic channel report plus other parameters, with

the additional data of the enhanced channel report advantageously multiplexed (e.g., time, code, and/or frequency division multiplexed) with the data of the basic channel report. Thus, the basic channel report may be viewed as providing a first level of detail about the downlink channel, while the enhanced channel report provides a second, more detailed view of the downlink channel, with the understanding that this more detailed view may be with relation to the same or different parameters. The specific parameters to be included in the enhanced channel report can be signaled to the mobile terminal 30 by the base station 14 explicitly, be implicitly signaled based on the enhanced feedback criteria used, or predetermined and programmed into the mobile terminal 30.

[0027] The setting of the one or more common feedback criteria (box 220) by the base station 14 is, as described above, advantageously based on those channel reports received by the base station in box 210, the data queued to be sent to the various mobile terminals 30, and the base station's scheduling scheme; although other parameters, and/or combination of parameters, may alternatively be considered. For a base station 14 using a "maximum throughput" scheduling scheme, the base station 14 may advantageously look at the channel reports from the mobile terminals 30 for the previous transmission time interval, determine an amount of desired enhanced channel reports (e.g., K), and set the common feedback criteria so that only K of the mobile terminals 30 would have exceeded a threshold established by the common feedback criteria. Alternatively, for a base station 14 using a "proportionally fair" scheduling scheme, the base station 14 may advantageously maintain a record of the average throughput of the mobile terminals 30. Then, based on the channel reports from the mobile terminals 30 for the previous transmission time interval, the base station 14 may calculate a current proportional fair metric for each mobile terminal 30, and then set the

common feedback criteria so that only K of the mobile terminals 30 would have their metrics for the current transmission time interval exceed a threshold established by the common feedback criteria. Of course, other considerations, such as the amount of data queued at the base station 14 should also be taken into account. It should be noted that under either scenario more or less than K mobile terminals 30 may end up transmitting enhanced channel reports based on the common feedback criteria, as the channel conditions may have changed from the previous transmission time interval to the current transmission time interval, but the setting of the common feedback criteria may still be viewed as controlling which of the plurality of mobile terminals 30 subsequently transmit an enhanced channel report regarding the downlink channel to the base station 14. Thus, the base station 14 may adaptively control the type of channel reports provided by the mobile terminals 30 through the selection of the proper common feedback criteria, and particularly the amount of enhanced channel reports that are provided from the plurality of mobile terminals 30.

[0028]   In several of the embodiments, the enhanced channel report is transmitted by the mobile terminal 30 during the same time interval as the basic channel report would normally be reported, on the same uplink channel and/or on a different uplink channel. Such a temporal arrangement is believed advantageous, as the base station 14 can thereby process and utilize the data from the channel reports provided from the various mobile terminals 30 in a timely fashion. However, some delay may be tolerated in providing the enhanced channel reports, such as if the enhanced channel report requires two or more transmission time intervals to transmit. In some embodiments, the transmission of channel reports by the mobile terminal 30 is performed on a periodic basis; but such is not strictly required, and the reporting may, for example, alternatively be non-periodic or triggered, as is desired.

[0029] As indicated above, the mobile terminal 30 determines whether or not to send an enhanced channel report based on the common feedback criterion (or criteria) broadcast by the base station 14. It should be noted that the condition whose satisfaction triggers the sending of the enhanced channel report may be multi-variable or single variable, depending on the particular embodiment. Further, the condition may be defined entirely by the common feedback criteria or may alternatively be defined by a combination of the common feedback criterion and some other information stored and/or calculated at the mobile terminal 30; either way the condition is considered as being based on the common feedback criterion (criteria). Further, satisfaction of the condition may mean meeting or failing to meet the condition, depending on the particular embodiment.

[0030] As used herein, the term "mobile terminal" 30 may include a cellular radiotelephone with or without a multi-line display; a Personal Communications System (PCS) terminal that may combine a cellular radiotelephone with data processing, facsimile and data communications capabilities; a PDA that can include a radiotelephone, pager, Internet/Intranet access, Web browser, organizer, calendar and/or a global positioning system (GPS) receiver; and a conventional laptop and/or palmtop receiver or other appliance that includes a radiotelephone transceiver. Mobile terminals 30 also may be referred to as "pervasive computing" devices. In one embodiment, shown in Figure 6, the mobile terminal 30 may include a user interface 32 (e.g., keyboard, display, microphone, speaker, etc.) coupled to a system controller 34. The system controller 34 communicates with receiver circuit(s) 40 and transmitter circuit(s) 42 and works in conjunction with a baseband processor 36. The receiver circuit(s) 40 and the transmitter circuit(s) 42 may optionally be combined into one or more transceiver circuits (not shown), but such an arrangement should be considered to

have both the receiver circuit 40 and the transmitter circuit 42 within the meaning of this document. The receiver circuit 40 and transmitter circuit 42 receive and transmit RF signals respectively via an antenna assembly 44, which is advantageously a multiple antenna arrangement. As the operational details of mobile terminals 30 in general are known to those of skill in the art and not critical to understanding the present invention, such details are omitted for brevity. However, it should be noted that in one or more exemplary embodiments, at least portions of receiver circuit 40 and/or the transmitter circuit 42 and/or the baseband processor 36 and/or the system controller 34 may be implemented as an Integrated Circuit (IC). Thus, for example, some or all of transmit circuit 40 and/or receiver circuit 42 may be implemented as coded program instructions stored in a computer-readable medium (such as memory device(s) which may comprise FLASH, EPROM, etc.) that instruct a processor to carry out the desired operations. Such a processor might be a Digital Signal Processor (DSP), a microprocessor or microcontroller, or might be a logic circuit (or circuits) implemented as part of an Application Specific Integrated Circuit (ASIC). Additionally, some or all of receiver or transmitter may be implemented as programmable or dedicated logic circuits within a Complex Programmable Logic Device (CPLD), Field Programmable Gate Array (FPGA), or other form of Integrated Circuit (IC). Of course, the foregoing embodiments are exemplary rather than exhaustive.

[0031] It should be noted that the mobile terminal 30 may be advantageously be programmed to operate in a Code Division Multiple Access (CDMA) environment, such as that known as WCDMA Release 5, but may alternatively be programmed to operate in a Time Division Multiple Access (TDMA) based wireless communication network, such as IS-136, GSM, or GSM/EDGE communication networks, or according to any other known wireless communications protocol. As such, while the majority of the

discussion above has been in the context of a WCDMA based wireless communication networks, it should be understood that the present invention may be applied in other types of wireless communication networks, such as those based on TDMA, GSM, IS-136, conventional CDMA, etc.

[0032] It should be noted that the present invention may, as indicated above, find particularly advantageous application in MIMO (multiple receive and multiple transmit antennas) type wireless communication systems. However, the present invention is not limited to such systems, and may be used other systems, such as, for example, SIMO (single receive, multiple transmit antennas) type wireless communication systems, MISO (multiple receive, single transmit antennas) type wireless communication systems, and SISO (single receive, single transmit antennas) type wireless communication systems, and/or hybrids thereof.

[0033] The discussion above has been in the context of the mobile terminal 30 determining whether or not to send an enhanced channel report based on the common feedback criterion (or criteria) broadcast by the base station 14. It should be noted that the mobile terminal may also be programmed to automatically transmit an enhanced channel report when the most recent packet was not received successfully.

[0034] Further, while discussion above has been in the context of the mobile terminal 30 determining whether or not to send an enhanced channel report based on the common feedback criterion (or criteria) broadcast by the base station 14, the approach can be generalized to allow the base station 14 to control when the mobile terminals 30 provide any channel reports. For this more general embodiment shown in Figure 7, the base station 14 receives channel reports from the mobile terminals 30 (box 410). Based on those channel reports, the data ready to be sent to the mobile terminals 30, and its scheduling scheme, the base station 14 determines if more, less, or generally

the same amount of channel reports from one or more mobile terminals 30 is desired.

Based on that determination, the base station 14 sets one or more common feedback

criteria and transmits the same to the mobile terminals 30 in a broadcast type message

(box 420). The mobile terminals 30 receive the common feedback criteria at box 430.

Each mobile terminal 30 then determines whether or not it satisfies a condition based on

the one or more common feedback criteria (box 440). If the mobile terminal 30 does not

satisfy the condition, the mobile terminal 30 does not send any channel report to the

base station 14 for that time period (box 450). If the mobile terminal 30 satisfies the

condition, then the mobile terminal 30 prepares a channel feedback report and transmits

the channel feedback report to the base station (box 460). The channel feedback report

of step 460 can be either the basic channel report or the enhanced channel report

described above. The base station 14 then receives the channel reports from the

various mobile terminals 30 (box 410), and the process continues. Thus, in the more

general approach of Figure 7, the mobile terminal 30 determines whether or not to send

any channel report based on the common feedback criterion (or criteria) broadcast by

the base station 14. Thus, the process of Figure 7 allows the base station 14 to

adaptively control when and/or how much the mobile terminals 30 provide any channel

reports.

[0035]   Fig. 8 shows a functional diagram of an exemplary base station 14 according

to one embodiment of the present invention. It will be appreciated that the present

invention is not limited to the base station architecture illustrated in Fig. 8, and that other

base station architectures are applicable to the present invention. As shown in Fig. 8,

base station 14 includes transmitter circuits 141, forward link signal processing circuits

142, receiver circuits 143, reverse link signals processing circuits 144, switch 146, and

control and interface circuits 148. The transmitter circuits 141 include the necessary RF

circuits, such as modulators and power amplifiers, to transmit signals to mobile

terminals 30. The forward link signal processing circuits 142 process the signals being

transmitted to the mobile terminals 30. Forward link signal processing may include

digital modulation, encoding, interleaving, encryption, and formatting. The receiver

circuits 143 comprise the RF components, such as a receiver front end, necessary to

receive signals form the mobile terminals 30. Reverse link processing circuits 144

process the signals received from the mobile terminals 30. Reverse link processing

may include, for example, digital demodulation, decoding, de-interleaving, and

decryption. Switch 146 connects the transmitter circuits 141 and the receiver circuits

143 to one or more antennas. Control and interface circuits 148 coordinate the

operation of the base station 14 and the mobile terminals 30 within the applicable

communication standards and interface the base station 14 with the RNC 12. The

forward link processing circuits 142, reverse link processing circuits 144, and control

and interface circuits 148 may be integrated in a single processor, or may be

implemented in multiple processors, hardware circuits, or a combination of processors

and hardware circuits. Further, the functional elements of Fig. 8 may be implemented in

software, hardware, or some combination of both. For example, one or more of the

functional elements in base station 14 may be implemented as stored program

instructions executed by one or more microprocessors or other logic circuits included in

base station 14, such as a microprocessor comprising the control and interface circuits

148.

[0036]   Given its broad range of applications and the variety of systems in which the

present invention may be implemented, those skilled in the art should appreciate that

the present invention may be embodied in any number of specific physical

implementations, including but not limited to the exemplary embodiment illustrated in the

Figures. More generally, the present invention may be embodied in hardware and/or software (including firmware, resident software, micro-code, etc.). Furthermore, some embodiments of the present invention may take the form, in whole or in part, of a computer program product on a computer-usable or computer-readable program code embodied in the medium for use by or in connection with an instruction execution system. In the context of this document, a computer-usable or computer-readable medium may be any medium that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device. By way of non-limiting example, the computer readable medium may take the form of suitable memory 34m in or accessible by controller 34 (e.g., random access memory, read only memory, programmable array logic, disk drive, etc.), or suitable memory 148m in or accessible to control and interface circuits 148, which may contain suitable program instructions to implement the method(s) described above.

[0037]   Additionally, those skilled in the art should recognize that, in general, the foregoing description and the accompanying illustrations represent exemplary embodiments of the present invention and should not be construed as limiting it. Indeed, the present invention is limited only by the following claims and the reasonable equivalents thereof.